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The issue of prematurity from a neurologopedist's perspective

Abstract: The article presents a neurologist's perspective on prematurity, which is associated with various consequences that manifest themselves in later development. Preterm birth is not only a shorter pregnancy, a smaller newborn, but most importantly, it is a tremendous consequence in the child's development and challenges for the infant's family. It involves the child's illnesses, more frequent visits to various specialists, difficulties in caring for such a tiny baby, but also the need to monitor the development of primitive functions and language and cognitive skills. The authors point out that, depending on the measures taken to minimize certain primordial disorders and the timing of their application, it is possible to meet children from premature births who need only stimulation of their development, but there are also those who, without systemic therapy, cannot find their way into the educational process.

Keywords: premature birth, neurologist, premature baby, neurodevelopmental disorders

Spojrzenie logopedy na zagadnienie wcześniactwa

Streszczenie: Artykuł prezentuje spojrzenie neurologopedy na wcześniactwo, które wiąże się z różnymi następstwami, ujawniającymi się w późniejszym rozwoju. Poród przedwczesny to nie tylko krótsza ciąża, mniejszy noworodek, ale przede wszystkim ogrom konsekwencji w rozwoju dziecka oraz wyzwania dla rodziny niemowlęcia. Wiąże się on z chorobami dziecka, częstszymi wizytami u różnych specjalistów, trudnościami w opiece nad tak maleńkim dzieckiem, ale także potrzebą monitorowania rozwoju funkcji prymarnych i umiejętności językowych i poznawczych. Autorki zwracają uwagę na fakt, iż w zależności od podjętych działań mających na celu zminimalizowanie określonych zaburzeń prymarnych oraz momentu ich zastosowania można spotkać dzieci z przedwczesnych porodów, które potrzebują jedynie stymulacji ich rozwoju, ale są też takie, które bez systemowej terapii, nie mogą się znaleźć w procesie edukacji.

Słowa klucze: poród przedwczesny, neurologopeda, wcześniak, zaburzenia neurorozwojowe

Introducion

Prematurity is a term that seems familiar to most of the public, but it is not at all certain that it is understood correctly. Many times we are confronted with information about the birth or rescue of a child who was born before the expected date. General public knowledge tends to be limited to the perception of a premature baby as a newborn born prematurely, that is, smaller, rather than focusing on the consequences of premature birth. Pregnancy lasts 280 days, or 40 weeks. It is assumed that a premature baby is a newborn born before the end of the 37th week. With regard to the maturity of a premature baby, a distinction is made:

- Late preterm infants -these are relatively mature newborns who were born between the completed 34th and 37th week of pregnancy.
- Very immature newborns –t his group includes babies born before 32 weeks of gestation. It is estimated to be 1% of all live births.
- Extremely immature newborns are premature babies whose fetal age has not exceeded 28 weeks of gestation. Studies show that this group of babies is about 0.4% of all live births.

Also of great importance for the classification of premature births is the birth weight of the newborn. Low birth weight is < 2500g. Depending on it, specific differences are marked regarding both morbidity and survival of newborns (Kornacka M.K, R. Bokiniec, 2018). Nowadays, premature birth is a challenge for doctors, but medicine is at a very high level and babies born as early as 22 weeks of pregnancy have a chance to survive. However, it is worth remembering that this is associated with various consequences for later development. Preterm birth is not only a shorter pregnancy, a smaller newborn, but most importantly, a huge number of consequences in the child's development and challenges for the infant's family. It involves the child's illnesses, more frequent visits to various specialists, as well as difficulties in caring for such a tiny child.

Consequences of preterm birth from a neurologopedist's perspective

A neurologopedist is one of many specialists accompanying a child from preterm birth. Without stepping into the shoes of doctors, physiotherapists or psychologists, he looks at the child (it is good that he can do this already in the neonatal ward, and then not wait until preschool or early school age to intervene) and observes many problems:

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- respiratory failure,
- immaturity of the nervous system,
- immaturity of the digestive system,
- undeveloped primitive functions (breathing, sucking, swallowing),
- disorders of muscle tone control,
- dysfunctions in the processing of sensory stimuli,
- damage within the sensory organs.

Depending on the measures taken to minimize certain primate disorders and the timing of their application, one can encounter a variety and varying degrees of the consequences of the above abnormalities: Depending on the measures taken to minimize certain primordial disorders and the timing of their application, one can encounter a variety and varying degrees of the consequences of the above abnormalities: problems with food intake, delayed speech development, articulatory defects, malocclusion, abnormal breathing pattern, motor deficits, cognitive dysfunction and also developmental complications caused by prematurity, such as delayed psychomotor and mental development, disorders in cognitive and emotional development, hearing disorders, visual defects for which speech therapy intervention is not enough.

In addition, late complications that manifest themselves at later stages of child/teenager development due to prematurity include: disorders of psychomotor development, cerebral palsy, intellectual disability, autism, emotional and behavioral disorders, attention deficit hyperactivity disorder, educational problems, respiratory diseases (infections, asthma, need for inhaled steroids), nutritional and metabolic disorders, hypertension.

Babies born prematurely are at increased risk for neurodevelopmental disorders, so many neonatal intensive care units provide routine observation of at-risk patients for on going developmental monitoring. Infants born very prematurely at gestational ages <32 weeks and those with complications in the neonatal period are considered high-risk groups (Shapiro-Mendoza, Lackritz 2012).

The younger the newborn, the higher the risk of periventricular bleeding (Gacka 2017). E. Helwich (2016) defined the critical age of babies at risk of damage between 24 and 29 weeks of age. Meanwhile, studies confirm that the closer to the due date (i.e., a mature preterm infant), the higher the risk of bleeding compared to babies born on time. The incidence of bleeding was divided on a four-stage scale based on the intensity and degree of damage. Grade I and II bleeding are not clearly concretized. Some researchers believe that there are no negative effects on child development. Others, however, have noted in several years of observation the appearance of gait disorders, postural stability control, and speech and hearing disorders in children whose development was normal at age 1 (Gacka 2017). In contrast, third- and fourth-degree strokes are accompanied by neurological problems, visual and hearing impairment, intellectual disability, epilepsy and contractile forms of cerebral palsy. A factor that negatively affects

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the CNS of children born prematurely (even those "late preterm") is the elevated concentration of bilirubin in the blood, manifested by pathological jaundice. This is related to the immaturity of the liver. The consequence of untreated jaundice can be impaired hearing and cognitive development (Zhang et all: 2024).

Actually, it should not be difficult to observe and diagnose children with problems caused by being born too early. Pediatric care balances are when developmental deficits can be observed and named. Unfortunately, all too often during such diagnoses, the lack or incomplete development of certain skills is merely justified by prematurity, without paying attention to the need for early support for parents and children. As a result, problems may be noticed at a later age and cause difficulties only at the preschool stage or (worse and far more often) only during school education. Deficits observed at school age most often already relate to the skills of reading, writing and counting, and significantly affect the overall learning process of children.

Troubles of orofacial disorders

A neurologopedist observes when a newborn's medical condition, the treatment process, and hospital and outpatient care procedures impede the natural development of communication skills. Medical procedures, such as the child's stay in an incubator, connection to a ventilator or probe severely limit the child's early actions, which are fundamental to the process of language acquisition, i.e.: making eye contact, gazing at the other person's face, imitating facial expressions, reciprocating smiles, movements of arms and legs.

In addition, all kinds of medical activities performed in the orofacial sphere, i.e. prolonged intubation and feeding through a probe, lead to a lowering of the threshold of sensitivity in the mouth and lip area, impaired control of muscle tone and difficulties within the primitive functions. The result is problems in food intake at subsequent stages of learning to eat, abnormal eating habits, food selectivity and problems in the process of realizing speech sounds. Also, the wrong type of feeding affects the child's way of breathing, even taking food through a pacifier can result in the development of habitual breathing through the mouth, which in turn results in sleeping with an open mouth, frequent respiratory infections, bite deformation, improper swallowing and the occurrence of speech defects when the child begins to speak.

In the standards of speech therapy management for newborns and infants, attention is paid to striving for physiological, motor stability and correct behavior of the child when starting and continuing feeding, which is expected to become the basis for proper development (Przybyla 2015).

Too early birth is also associated with anatomical abnormalities in the oro-facial area, resulting from the shortened maturation time of individual structures. "During the last three months of pregnancy, under the influence of the motor activity of the lingual muscles, the lateral palatal ridges atrophy. A flat palate image is then formed, which is typical for newborns born on time" (K. Kaczorowska-Bray, M. Zielińska-Burek 2012: 82). Premature babies can come into the world with a retained narrow and overly arched palate, known as a gothic palate, which can cause not only difficulties with food intake, but also with articulation. Preterm birth also carries the risk of children having problems in motor development, which in turn very often signal delays in cognitive, emotional and social development (Cieszyńska, Korendo 2015).

Muscle tension disorders do not only affect postural muscles, but also articulatory muscles. Motor skills are extremely important in the context of mastering communication skills. In normative development, a parallel is observed between motor and speech development and play and speech. The speech development process itself is extremely orderly, and most child language researchers agree that two major stages can be distinguished here. Firstly, the prelingual period, which lasts from the moment of birth until about the first year of life, a feature of which is the so-called protoconversation (Kuszak 2014) and is also a preparatory period, and secondly the lingual stage, which has its beginning when the first words are spoken. Various types of motor deficits, i.e. lack of uprightness, difficulties in locomotion, coordination in planning movements in the large and/or small motor areas negatively affect the planning of speech organ movements. This particular type of movement, which are the rapidly changing systems of the mandible, lips, tongue, soft palate, may not develop normatively as a result of difficulties observed in the development of primitive activities. It may also not be activated if the child, while in the neonatal ward, is deprived of the opportunity to conduct this first, specific type of dialogue with an adult, the so-called protodialogue. Consequently, premature infants may present delayed speech development or articulatory defects. Motor and sensory systems (visual, auditory, sensory) are specific and modally develop according to genetically determined stages. External stimuli - environmental, as well as educational influences and specific self-activity, which in the case of preterm children may be peculiar and to some extent limited, are also a factor modulating this development.

Perceptual disorders

Another dysfunction observed in preterm children related to the shortened duration of fetal life affects the sensory analyzers. The immaturity of individual organs and the excess of negative sensory stimuli provided during hospitaliza-

tion in the form of noise or intense light, lack of proximity significantly affect the cognitive development of children born prematurely. The senses of hearing and vision are particularly susceptible to being shaped by experience, and a constant supply of stimuli is essential for the proper functioning of the CNS. Dysfunctions most often affect the visual and auditory organs. The level of processing of visual and auditory information depends on the degree of damage and the quality of perceptual experience. At 25 t.c., the child begins to respond to light, thus it is the beginning of the exercise of opening and closing the eyelids, which until then remained fused, closed. The eyeballs move sideways, up and down in response to light. From the end of the fetal 6 months, the baby has the opportunity, by distinguishing the intensity of light, to learn the mother's diurnal rhythm.

It still remains in twilight, but the retina, by emitting its own signals, stimulates the cerebral cortex to make new connections. This is what it looks like in the womb, but when a baby at this time, still too early, nevertheless comes into the world, many of these processes do not take place. The most common eye disease in premature babies is retinopathy, because at the time of birth the baby's retina is not fully formed, and the process of its maturation continues after birth even in babies born on time. All the more reason, therefore, for early diagnosis and observation of the child not only during infancy, but at least until the child starts school. Retinopathy even if treated can result in various complications, for example: glaucoma, cataracts, visual defects.

It can also give a worse course of other consequences of prematurity, such as: myopia, astigmatism, strabismus or late retinal detachment. In addition, visual function problems that negatively affect a child's overall development can include: reduced levels of visual analysis and synthesis, impaired directional function, difficulty perceiving similarities and differences, reduced eye-hand coordination skills, and visual attention disorders. If there are additional abnormal neuro-environmental stimulations during infancy and preschool, such as exposure to high technology, the difficulties presented by premature infants can be very severe. As researchers of this problem state, "Since the discovery of how our ancestors used tools, the human brain has not struggled with such a serious and dramatic challenge" (Small, Vorgan 2011: 14). Thus, at the time of checking school readiness in premature children, great difficulties in visual perception will be observed. Unfortunately, there is already little time to compensate for the deficits before the child enters the thresholds of school. From then on, the difficulties will only increase. Irretrievably, time is lost, which should have been used to support the premature child. Olga Przybyla (2020) draws attention to the importance of the senses of taste and touch, as well as smell, in regulating a child's behavior. Premature infants are deprived of the opportunity to form the first reactions mediated by smell between mother and child for a certain period of time, after all, olfactory stimulus shapes orientation and promotes evaluation of the immediate environment. Therefore, it is feeding time that becomes

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an opportunity to receive stimuli through multiple senses: "Through taste, smell, touch and body positioning, the child learns to recognize individual sensations. It is very important that this time is realized in a friendly environment, devoid of additional modal stimulation, that is, in a muted environment, with subdued light, devoid of additional odor stimuli" (Przybyla 2020: 114). Staying in a hospital ward is not conducive to proper stimulation, and thus can cause a child to feel uncomfortable and create a sense of anxiety. The consequences of such a condition are evident in children's later development.

During the third trimester of pregnancy, the baby quickly becomes accustomed to environmental sounds. The fetus' motor response to a variety of acoustic stimuli is evidence of normal nervous system development at this time. It has also been proven that the fetus reacts differently to sounds from the home environment, and differently to external sounds that it may experience when the mother walks. The variability of intensities and frequencies richer outdoors significantly affects the development of the vegetative system, which is responsible for controlling physiological activities (Cieszyńska-Rożek 2018). On the other hand, preterm children experience this time differently, and therefore, within the auditory functions of preterm children, in addition to various types of hearing loss, one can notice in the preschool and then early school period, among others: reduced levels of analysis and synthesis of sound stimuli, phonemic hearing disorders, speech fluency, problems with auditory attention and writing by ear, and difficulties in understanding verbal messages in noise. All these problems could be significantly resolved if the child received specialized support in the preschool period.

Imitation and emotion

During the prenatal period, a system of mirror neurons begins to function, and it is through their activity that the fetus communicates with the mother. Around the 22nd week of pregnancy it makes intentional movements. Later in pregnancy, connections are formed between the motor areas of the brain and the fields that provide perception of visual stimuli. This makes it possible for newborns to acquire the ability to imitate movements made by caregivers as well as for the young organism to bond with the social world. In the last trimester of pregnancy, the development of the sensorimotor area, which is particularly important for the development of speech, is carried out. Children from premature births do not have time for this. Whether or not this period will be irretrievably lost can be decided by specialists, who will give timely attention to the need for additional interventions to support the child's development.

In addition, hospitalization also carries the risk of emotional problems for preterm children as a result of the prolonged stress experienced in the neonatal intensive care unit. Increasingly, the results of psychological studies point to this aspect as one of the causes of difficulties observed not only in the preschool and school period, but also already in adult life. The unnatural conditions of puberty, unfamiliar external stimuli, pain associated with medical and nursing activities, and above all, the separation of the child from its mother are a source of fear and constant tension. Negative emotions and a disturbed sense of security can lead to serious psychological consequences, which may contribute to the development of abnormal behavior patterns in the future. Another very important aspect of development should also be taken into account here: "Without cohabitation - interaction and sharing of emotions, the child will not activate the processes of imitation, understanding and independent construction of statements" (Cieszyńska-Rożek, 2022:11). Under the influence of interaction with parents, siblings, caregivers has a chance to activate the social brain so important for the process of learning speech. The most important information for an infant comes from the facial expressions and eye movements of people leaning over him daily and systematically. Thus, the shortened time of acquiring the experiences of the fetal life period is the source of many failures, and the consequence of abnormalities in the senses is also difficulties in the process of language acquisition and the development of cognitive functions.

Supporting the development of a premature infant

Recognizing the problem, monitoring and supporting development allows overcoming difficulties resulting from immaturity. A neurologopedist plays a significant role in the process of improving individual functions and overcoming deficits that appear at different periods of a premature infant's development. Therapeutic work begins as early as in the neonatal ward, just after the newborn's vital functions have stabilized, and can last for a very long time, depending on the depth of the child's psychophysical and language disorders. Multispecialized medical-rehabilitation-logopedic and psychological stimulation prevents the worsening of deficits and significantly improves the quality of life of premature babies and their families. "The stimulation of a young child's development, and therefore its therapy, should be understood as a conscious, systemic influence of specialists and the home environment on all cognitive spheres, in order to optimally level the effects of disorders caused by genetic or perinatal damage" (Cieszyńska, Korendo 2015: 15). Early speech therapy intervention, should be understood as a series of measures that can prevent the development of abnormalities in the development of a child's

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speech at a later age (Kackieło-Tomulewicz et al. 2020), and is particularly important in the prevention of children from premature births. The high risk of speech disorders, due to possible damage to the nervous system and dysfunctions within cognitive areas, prompts stimulation from the first months of life. Therapy covering all developmental spheres based on the latest neurobiological knowledge should be programmed from the moment worrying symptoms are identified. Due to the mechanism of neuroplasticity - the brain's ability to permanently change neuronal responses under the influence of learning, the timing of the start of interventions is crucial in this procedure. Therapeutic exercises during the critical period (the first three years of a child's life), when neuronal plasticity is at its highest, enable the transmission of a signal from one nerve cell to another and in this way a memory trace is built between neurons (Vetulani 2014), which is why early prevention is so important in the development of premature babies. Neurobiological therapy takes into account all human cognitive functions, assuming their mutual influence on the processing and storage of information. It is further based on the assumption that the child must be active during activities, acting independently to accumulate experience and build language (Cieszyńska-Rożek 2013).

Standards of care for the preterm/newborn child, developed by both neonatologists and speech therapists (Feige 2012, Przybyla 2015, Kaczorowska-Bray, Zabilitowski et al. 2018, Zabilitowski et al. 2022, Lorens 2023) clearly define the scope of neurologopedic interventions while still in the hospital ward and in the first months of a premature infant's life. These include:

- monitoring and supporting the development of the young patient,
- checking reflexes,
- assessing the anatomical conditions of the oral cavity,
- speech therapy rehabilitation through manual interventions,
- prophylaxis of correct chewing and swallowing,
- cooperation with parents and development of their parental competence by showing correct feeding patterns and nursing methods.

The detailed scope of activities presents as follows:

- 1.5-2 months of age - assessment of the quality of the child's eating, possible selection of feeding accessories;
- 3 months of age - assessment of the quality of the child's eating, possible selection of feeding accessories, possible activities in the field of neurodevelopmental stimulation/therapy;
- 6-7 months of age - assessment of the development of digestive functions, assessment of techniques and quality of eating- assessment of baseline communication skills and speech development;
- 10-12 months of age - assessment of the development of digestive functions, evaluation of eating techniques and quality of eating as well as the development of communication skills and speech development;

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- 16-18 months of age - further assessment of the development of communication skills and speech development (Zabilitowski 201,2022).

It is also the duty of the therapist to inform the family about important developmental milestones and possible consequences of premature birth. Importantly, neurologopedic assistance does not end when the child leaves the hospital wards.

Although returning home should reassure the parents somewhat, after all, the child's condition was stabilized in the hospital, the very moment of crossing the threshold of home is also very difficult, after all, it is necessary to create conditions for the child to develop properly. Then it is no longer only specialized medical care that will continue, but also the thoughtful actions of the therapist, fully individualized to the needs of the child, can assist the family in terms of exemplary daily stimulation. The neurologopedist will implement interactions to improve functioning by stimulating all cognitive areas, supporting the development of the language system and communication skills. Jeanie L., Cheong and Lex W. Doyle (2017), in a study of children with moderate and late prematurity, showed that compared to a control group of children with on-time birth, poorer cognitive, linguistic and motor development at 2 years of age (including corrected age) with a regular pattern of the most severe deficits for language development and secondarily for motor and cognitive development. Children with moderate and late prematurity presented developmental delay compared to their term-born peers, most marked in the area of language. Continuing the theme of the specific development of prematurely born children, studies showing neurodevelopmental deficits or assuming a significant probability of their occurrence (Ropero-Padilla et all,2024, Ryan 2023, Morniroli et all, 2023, Pascal at all, 2023, Perisset 2023, Honnorat 2023, Larsen at all 2022, Chung, Cow, Brown 2020, Favrais 2019, McGowan 2019, Jois 2019, 2018, clearly indicate the need to extend beyond 3 years of age the developmental monitoring of this group of children.

Conclusion

Every year, more than 20,000 premature babies are born in Poland. Even babies weighing 0.5 kg have a chance of survival, which is a great success for Polish neonatology. However, better developmental care for premature babies is still needed, which, according to the national consultant for neonatology, should last a minimum of three years. There is also a lack of a network of medical centers providing comprehensive and coordinated care.

However, advances in the field of medicine and speech therapy offer opportunities to compensate for the lost days. The timing of the recognition of the

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problem, the immediacy of the interventions taken, regardless of the corrected age data, the continuity of interventions, the interdisciplinarity of early intervention and the basing of therapeutic measures on neurobiological knowledge can bring the desired results. Specialized assistance in the form of correcting deficits and consolidating achieved abilities creates opportunities for premature babies to catch up with their peers born on time.

In conclusion, the plan of action of the speech therapist in the context of the care of the child born prematurely should be as follows:

1. up to the age of 36 m. intensive multispecialist care → 2. support of the child's development during the preschool period →3. reassessment-diagnosis before the start of preschool ed. → 4. support of the formation of school skills: speaking, listening, reading, writing → 5. before the entire period indicated monitoring and possible therapeutic interventions in the sphere of cognitive, social, emotional development and mental health.

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