The course and support of sensorimotor development in a premature infant

Przebieg i wspieranie rozwoju sensomotorycznego dziecka urodzonego przedwczesnie

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Key words
premature infant, sensorimotor stimulation, rehabilitation

Abstract

Introduction: Prematurely born babies account for nearly 7% of all infants coming into the world, and there are more and more extremely small premature babies being born. A report covering 184 countries shows that each year, 14.9 million children are born ahead of time. Maintaining life is the first task faced by the medical service. The issue regarding development and the future of these children is the next stage of interest for both doctors and a number of specialists from related fields.

Aim: The aim of the study was to review literature concerning premature newborns in the field of sensorimotor development within the first years of life, taking into account the hazards and possible forms of early support. An attempt was made to present the current state of knowledge in the scope of recommended and used methods of conduct as well as to assess the long-term effects of undertaken interventions.

Methodology: A review of Polish-, English- and French-language literature was conducted, which concerned sensory motor development, introduction of early rehabilitation and support programmes for premature infants. Research papers and review works from the last 10 years included in databases (PubMed and websites of Polish medical publishing houses) were analysed. The works were searched using the following keywords: premature baby, sensorimotor development.

Results and conclusions: The growing group of preemies requires adapted care. To counteract the indicated threats, a therapeutic intervention should be introduced precisely and in accordance with a child’s needs. There is a need to broaden knowledge about development in this group of children and to create a proven developmental support system that would be based on long-term research. Currently, support for babies born too early is heterogeneous, and the research carried out does not allow to design a single support model or clearly defined standards of conduct.

Stłowa kluczowa
wcześniak, stymulacja sensoryczna, rehabilitacja

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Streszczenie

Wstęp: Noworodki urodzone przedwczesnie stanowią blisko 7% wszystkich urodzonych dzieci i przybywa dzieci urodzonych jako ekstremalnie małe wcześniaki. Raport obejmujący 184 kraje wskazuje, że każdego roku 14,9 miliona dzieci rodzi się przed czasem. Utrzymanie życia jest pierwszym zadaniem, które stoi przed służbą medyczną. Kwestia rozwoju i przyszłości tych dzieci to następny etap pozostający w kręgu zainteresowań zarówno lekarzy, jak i szeregu specjalistów z pokrewnych dziedzin.

Cel: Celem pracy było przeprowadzenie przeglądu piśmiennictwa dotyczącego noworodków urodzonych przedwczesnie w zakresie rozwoju sensomotorycznego w pierwszych latach życia, z uwzględnieniem występujących zagrożeń oraz możliwych form wczesnego wsparcia. Podjęto próbę przedstawienia aktualnego stanu wiedzy w zakresie zalecanych i wykorzystywanych metod postępowania, a także oceny długofalowych skutków podejmowanych interwencji.

The individual division of this paper was as follows: a – research work project; B – data collection; C – statistical analysis; D – data interpretation; E – manuscript compilation; F – publication search

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Until the end of the 19th century, the time when neither the paediatrician nor the obstetrician joined in the care of a child during the neonatal period gained the name “no man’s land”. Currently, the neonatal period is an area where not only the midwife and the paediatrician are involved, but also, among others, a neonatologist, neurologist, physiotherapist, a speech therapist in neurology and psychology.

The aim of the study was to review the literature concerning premature newborns in the field of sensory and motor development during the preschool period, taking the hazards and indicated forms of intervention into account. A review of Polish-, English- and French-language literature was conducted, which concerned sensorimotor development and early rehabilitation of premature babies.

Neonates born ahead of time are currently close to 7% of all children coming into the world. They constitute a large and diverse group of children, therefore, the introduced division is according to age and weight at birth. The classification is presented in Figure 1. The development of neonatology allows us to keep smaller and increasingly born children alive. At the same time, shortening the duration of pregnancy correlates with the increase in the level of central nervous system coordination disorders. Figure 2 presents the results of research conducted in France – children born between the 24th and 28th week of pregnancy almost 2.5 times more often require specialist support within the first 5 years of life than children born full-term.

Due to high immaturity, premature newborns have many problems, including respiratory failure, retinopathy or thermoregulatory disorders. About 15% of children born before the 26th week of pregnancy with a weight of less than 1,000 g suffer from severe developmental disorders. The need for interdisciplinary support of premature babies to optimize their development is emphasized. This is a special group of patients who, due to the disruption of physiological progress, often develop non-harmoniously and require special attention and aid.

**BIRTH AGE AND CORRECTED AGE**

In the process of assessment of children’s development and rehabilitation, it is advisable to relate developmental assessment to the corrected age and not to the actual age of birth until the child is at least 18 months old, and the child’s development should be subjected to monitoring until the corrected age of 2. According to the guidelines of the NDT Bobath neurodevelopmental concept, age correction is recommended until the second year of a child’s life. Generally, within the second year of age, the concept of corrected age is no longer used and the child’s development refers to the age of birth, however, opinions on this issue are ambiguous. It is indicated that in some premature babies, certain functions, e.g. speech development, may be corrected even up to the age of 3.

**SENSORY ASPECTS OF A PREMATURE INFANT’S DEVELOPMENT**

According to currently adopted views, the development of an infant is a sensorimotor educational process. The child must be seen as a child not only on the basis of chronological age but also on the basis of the child’s development.
whole due to the indissolubility of sensory and motor systems, and disturbances within one of these systems may affect the development of the second one. Pre-term delivery and low birth weight are indicated as one of the main causes of sensory processing disorders. According to the stance of the Polish Gynecological Society, “health is shaped from the early stages of individual life, so the physical and intellectual development of a child depends on the proper course of pregnancy and childbirth.” In a child born prematurely, the first sensations are often significantly different than in a full-term newborn, and it is emphasized that the first sensory experiences of the child, which arise through both touching and being touched, affect the development of the sensation of touch at later stages of life, motor development and the way of perceiving the physical world. Children staying at Intensive Neonatal Care Wards receive excess stimulation associated with medical procedures, and too little gentle stimulation to support development. Research indicates that appropriate stimulation (in the form of a customized massage, gentle continuous touch, kangaroo care) conducted a few minutes a day improves health (among others, improvement of saturation, increase in liveliness, weight gain, shortening hospitalization by an average of 6 days). Numerous studies confirm the positive effect of tactile stimulation on the development of premature babies; however, the study lacks information on adverse events during such interventions, as well as specific standards of such stimulation. It is emphasized that the introduction of adapted tactile (both in the oral area and beyond) and kinaesthetic stimulation in premature babies influences building the food-feeding competence.

It is also recommended to modify the child’s environmental characteristics, including light and noise intensity, exposure to aromas, tactile stimuli or changes in position. Premature babies born between 24 and 26 weeks of foetal life may be exposed to olfactory sensations that are considered to be irritating from 3,500 to 4,200 times during the entire period of hospitalization.

### REHABILITATION OF PREMATURE INFANTS

Another important aspect is the introduction of stimulation or rehabilitation in a child born prematurely. Numerous authors warn against over-rehabilitation and emphasize that it is not necessary for every prematurely child born to undergo rehabilitation. On the other hand, the importance of early physical therapy, proper nursing stimulation of the child's development by parents has been increasingly appreciated in recent years. The importance of parents' education regarding the principles of proper care and stimulation as an important element of the treatment process is emphasized. For this reason, the “Programme for early stimulation and developmental care of a newborn” was created, which was based on the assumptions of the NDT-Bobath neurodevelopmental school of therapy.

The importance of early rehabilitation, emphasizing significant benefits especially in patients with central nervous system damage, is underlined. The research conducted at the Provincidal Integrated Hospital in Toruń indicated that from a group of 50 premature babies, 64% required rehabilitation within their first two years of life. Psychomotor development adequate to corrected age was achieved by 86% of children at the age of 2, while children born before the 29th week of pregnancy usually required constant doctor’s care and rehabilitation. The research conducted at the Specialist Rehabilitation Clinic for Children of the Provincial Hospital in Rzeszów on a group of 64 prematurely born children systematically undergoing rehabilitation showed that the early introduction of motor rehabilitation influenced the equalization of development deficits during the first half of the year. However, it is often emphasized in literature that children born pre-term require long-term observation.

It is recommended that the supportive procedure begin already during the stay at the neonatal pathology department by stimulation as part of the care, and in the case of indications, to start rehabilitation, e.g. using the Vojta method. Other methods of early stimulation include the NDT Bobath concept, the Kinesiology Taping method particularly useful for this group of children, and the Neonatal Behavioral Assessment Scale (NBAS) developed by T.B. Bra-
zelt, which enables diagnostic and therapeutic interventions. NBAS is a valuable tool for both medical staff and parents, allowing assessment with regard to the personality of the newborn, its sleep and wakefulness cycle and habituation skills. Prematurely born children can also be assessed using Prechtl’s method as a valuable complementary tool to classic neurological examination of a child. It is indicated that neither the change of gravity after birth nor CNS maturation affect the occurrence of motor patterns assessed in this method, only global movements in premature babies may have higher amplitude and velocity. In recent years, the introduction of OMT (Osteopathic Manipulative Treatment) techniques has been undertaken in work with prematurely born children, and, as the first research results show, it causes, inter alia, a significant reduction in the time of hospitalization. The literature also presents the positive effects of music therapy observed in the studies (including regulation of heart rhythm, regulation of the sucking reflex, shortening hospitalization period). Some studies also indicate that music therapy reduces physiological and behavioural pain responses during and after blood collection. All physiotherapeutic interventions should be conducted in cooperation with a neonatologist and midwife in order to properly interpret the monitored functions so that the procedures are safe for the child.

Due to premature interventions in children, reduced bone density observed in this group of children and reduced mineral content are extremely significant. About 10-12% of these children show cracks and fractures during the first period of their lives. The introduction of physical stimulation and rehabilitation must be adapted to the child’s health condition. The bone mineral content in premature babies may be near proper parameters at approximately 12 months of age. However, as research shows, physical exercise in the form of passive exercise, performed everyday as part of premature baby care, stimulates the synthesis of the bone matrix, becoming a preventive measure in osteopenia. In children born before 32 weeks of gestation, there is a greater risk of developing symmetrical and asymmetrical skull deformities (compared to children born on time and to children born between 32 and 37 weeks of pregnancy), and therefore, it is necessary to prevent deformities already in the first period of a child’s life at the hospital.

PROGRAMMES AND SYSTEMS SUPPORTING DEVELOPMENT

Due to the perceived need for special care in children born prematurely, the “Newborn Individualized Developmental Care and Assessment Program” (NIDCAP) was created at Boston Children’s Hospital. This programme, which is undergoing modifications, is distributed not only within the United States of America, but also in Europe and South America. The aim of the programme is to provide the child with optimal care and comfort (despite the introduction of medical procedures). NIDCAP is both a philosophy and practice, where despite high immaturity, the newborn is an entity and cooperation with him/her and his/her parents is the basis of the whole programme. The results of the study indicated that in relation to growth-weight parameters and psychomotor development, children undergoing the programme show more efficient functioning.

As demonstrated by French experiments among prematurely born children and their families, an early-care programme is extremely important for parents as it reduces their level of anxiety and improves the relationship between the parents and child. Proper care, feeding, carrying a newborn and fun in a proper way will not affect the relationship between mother and child and may be included in the physiological day schedule while becoming a great way to support and stimulate the development of a child.

The University of Amsterdam examined the impact of the early assessment and intervention programme, which was intended for children with very low birth weight (Infant Behavioral Assessment & Intervention Program – IBAIP). Within this programme, the child (from birth to 6 months) and their parents underwent 6 to 8 consultations at their place of residence with a specially trained physiotherapist. The parents received information on proper care and support of the child’s development on a constant basis. The children included in the programme achieved better prognosis in the field of motor development. Within the Polish (Wrocław) context, in the interdisciplinary scientific community (doctors, psychologists, pedagogues and physiotherapists), the idea of early diagnosis and therapy of children with developmental disorders was created (also addressed to the growing number of premature newborns) – the Wrocław Rehabilitation Model (WRM). The key elements of the programme are: sensory integration, speech stimulation, education of motor patterns and behaviours, as well as building independence and social development of an individual. The foundation of this programme is also cooperation with parents and support from birth.

The importance of the early intervention programme as support for the whole family and not just the child itself, is necessary to focus on the parent-child relationship. Shaping the support programme in the family also brings functional benefits in terms of the child’s cognitive and motor development. Parents of newborns born prematurely are at risk of improper functioning as a mother or father due to the extremely intense emotions and situations that affect cognitive, emotional and social spheres. At the same time, family is a place where a child saturates physiological and psychological needs, and experiencing a safe relationship and adapted care creates the prospect of optimal development. Support provided to parents in the form of care and appreciation of their efforts will help them determine their place and give them some faith in their parental competences.
CONCLUSIONS

In the presented publications, there is a limited amount of information pertaining to the quality of motor function of children born prematurely. Few studies show the functioning of a prematurely born child with regard to various areas of development (e.g., gross motor skills, independence, perception). Performance and endurance in later life are also not assessed. At present, there are no explicit guidelines regarding the application of corrected care. The development and use of support programmes in the group of premature newborns indicates high awareness of the medical environ-

ment regarding the special needs required by this group, as well as the challenges faced when caring for the really little ones. In numerous publications, the authors point out that premature is not only a medical but also social problem. We also find examples of interventions supporting sensorimotor development of a premature infant. Nevertheless, there are still no unambiguous standards of conduct in their implementation. Few studies are conducted in the long term and provide an opportunity to assess a child’s development in the context of specific interventions or improvement programmes, which would allow the development of the most effective models of support.

Conflict of interest: none

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